

Mr. Hackenberg — (WARM-UP)

① The equation for free fall on Mars is $s = 1.86 t^2$ ^{m/s²} with t in seconds.

Assume a rock is dropped from a 200 ft cliff.

a. Find the average speed over the interval $[2, 4]$.

b. Find the speed at $t = 1$ second.

② What is the rate of change of the volume of a sphere ($V = \frac{4}{3}\pi r^3$) with respect to the radius when $r = 3$ inches?

$$s = 1.86 t^2 \text{ m/s}^2 \quad (200 \text{ ft.})$$

$$\frac{29.76 - 7.44}{4 - 2}$$

a. 1.86

$$\frac{7.44}{29.76}$$

~~4~~

$$\frac{29.76 - 7.44}{2}$$

$$\boxed{11.16}$$

b. $1.86(t+h)^2 - 1.86t^2$

$$\cancel{1.86t^2} + 3.72th + 1.86h^2 - \cancel{1.86t^2}$$

$$3.72th + 1.86h^2$$

$$3.72t + 1.86h$$

n

$$\boxed{3.72} \text{ m/s}$$

$$\textcircled{2} \quad V = \frac{4}{3} \pi r^3$$

~~$$V(3) = 113.1$$~~

~~$$V(3+h) = 113.1 + \Delta V$$~~

~~$$\Delta V = V(3+h) - V(3)$$~~

~~$$= \frac{4}{3} \pi (3+h)^3 - \frac{4}{3} \pi (3)^3$$~~

~~$$= \frac{4}{3} \pi (27 + 27h + 9h^2 + h^3) - \frac{4}{3} \pi (27)$$~~

~~$$= \frac{4}{3} \pi (27h + 9h^2 + h^3)$$~~

~~$$= 4\pi (9h + 3h^2 + \frac{1}{3}h^3)$$~~

~~$$= 4\pi (9(3) + 3(3)^2 + \frac{1}{3}(3)^3)$$~~

~~$$= 4\pi (27 + 27 + 3)$$~~

~~$$= 4\pi (57)$$~~

~~$$= 716.38$$~~

~~$$\Delta V = 716.38 - 113.1$$~~

~~$$= 603.28$$~~

$$4.18x^3$$

$$= \frac{4.18(x+h)^3 - 4.18(x)^3}{h}$$

$$= \frac{4.18(x^3 + 3x^2h + 3xh^2 + h^3) - 4.18x^3}{h}$$

$$= \frac{4.18x^3 + 12.56x^2h + 12.56xh^2 + 4.18h^3 - 4.18x^3}{h}$$

$$= 12.56x^2 + 12.56xh + 4.18h$$

$$= 12.56(3)^2 + 12.56(3)h + 4.18h$$

$$\xrightarrow{h \rightarrow 0} 113.09$$

$$1\ b) \quad \lim_{h \rightarrow 0} \frac{f(t+h) - f(t)}{h}$$

$$S = 1.86t^2$$

$$f(t) = 1.86t^2$$

$$\frac{1.86(t+h)^2 - 1.86t^2}{h}$$

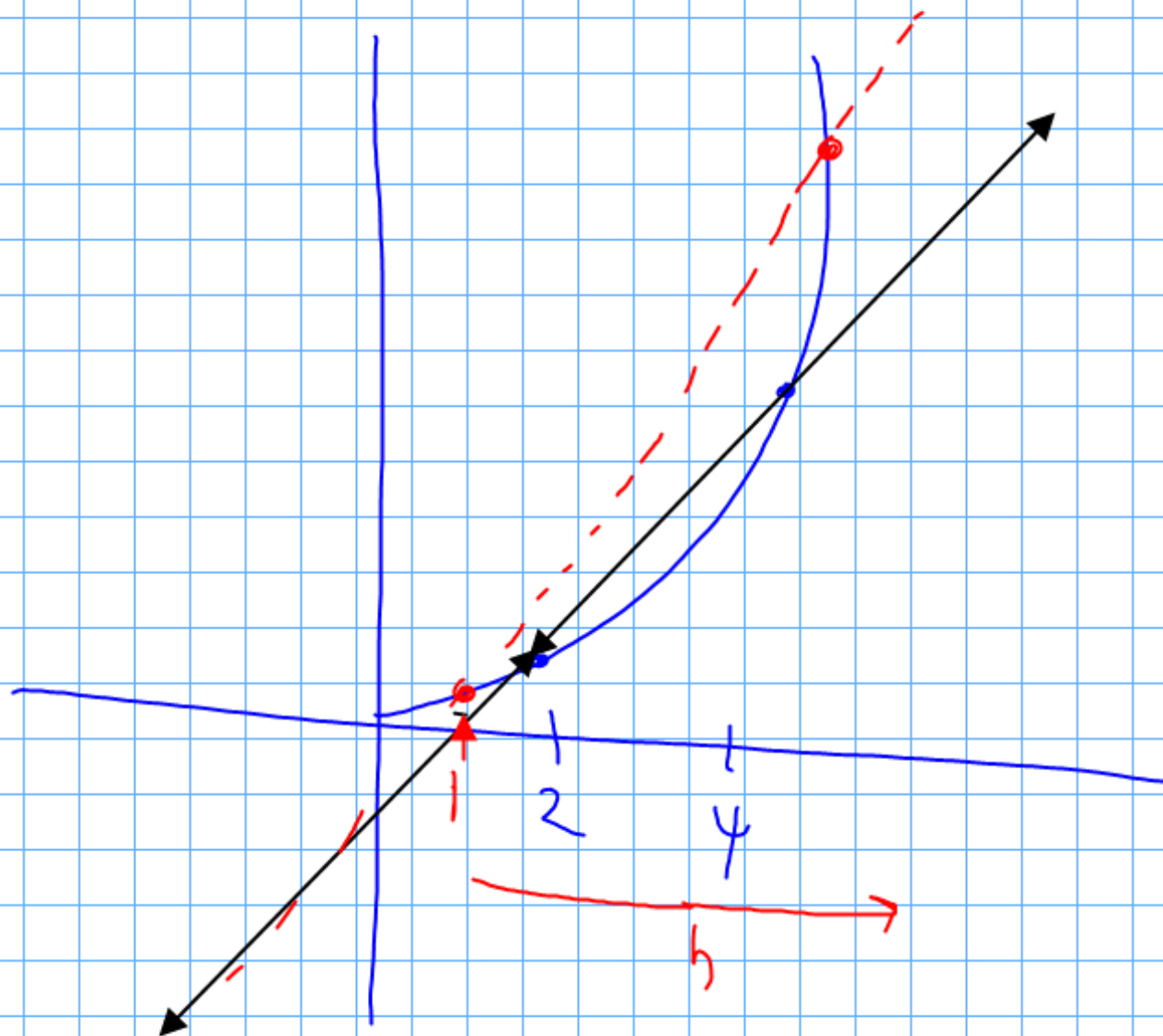
$$\frac{1.86(t^2 + 2th + h^2) - 1.86t^2}{h}$$

$$\frac{1.86(\cancel{t^2} + 2th + h^2 - \cancel{t^2})}{h}$$

$$\cancel{h} \frac{1.86(2t + h)}{\cancel{h}}$$

$$1.86(2t+h)$$

$$1.86(2t)$$



HW: Section 2.4: 2, 3, 6, 7, 9, 10, 15, 17, 19, 20, 23, 25, 28, 29, 33, Quick Quiz AP (end of section).